AIR QUALITY

I. INTRODUCTION

Considerable progress has been made in Southern California to clear the skies over the past 30 years—in the face of rapid growth in population, housing, employment, and vehicle miles traveled. Effective federal, state, and regional requirements and successful regional air quality action plans (AQMP/SIPs) have jointly reduced hundreds of tons of air pollution each day from mobile, area, and stationary sources in Southern California. However, recent trends and emerging health evidence indicate that much more work will be needed to achieve healthful air for all Southern Californians.

Ambient air quality trends over the last five years indicate that progress appears to be stalling, and emerging evidence from the health community suggests that health impacts, especially from exposure to fine and ultra-fine diesel particulate pollution, may be more severe than previously understood. In light of this evidence, and considering the dramatic increase in diesel emissions that could occur over the next 25 years if the projected increase in emissions from international trade is not adequately abated, then more effective, health-based strategies must be implemented as soon as feasible. If the region does not attain healthful air by the federally required schedules, our quality of life and our federal transportation funding will be jeopardized. Various activities are currently underway to overcome this challenge, and the RCP Air Quality Element can help coordinate these various activities and help identify additional actions needed to effectively reduce emissions, especially from growing diesel emissions sources, including ships, locomotives, and the port complexes.

The purpose of the air quality chapter is to help guide and coordinate the various air quality and land use activities in Southern California. This coordination will help us work together to attain federal and state air quality standards and achieve healthful air for all Southern California residents. Southern California has the worst air quality in the nation, and this challenge calls for aggressive, inclusive actions. The Air Quality chapter of the Regional Comprehensive Plan can coordinate the related efforts to help us implement the most effective technologies, transportation investments, urban form, and consumer choices, which reduce air pollution, improve air quality, and protect health and the environment.

The primary audiences for the Regional Comprehensive Plan are local decision-makers, community and business leaders, planners/policy analysts, not-for-profit groups, and other stakeholders in Southern California. In addition, the RCP Air Quality Chapter is intended to be interesting to the general public and the media, with the goal of providing a useful tool to help communicate individual behaviors and consumer choices, which could, collectively, provide substantial improvements to ambient air quality.

II. EXISTING SETTING AND CONDITIONS

Environmental Setting

The environmental setting addresses issues related to air pollutant emissions, including *criteria air pollutants* and *toxic air contaminants*. The term *criteria air pollutants* refers to those pollutants that are pervasive in urban environments and for which health-based

state or national ambient air quality standards have been established. The term *toxic air contaminants* refers to those pollutants that occur at relatively low concentrations and are associated with carcinogenic and other adverse health effects, but for which no ambient air quality standards have been established. Criteria pollutants and toxic air contaminants are discussed in separate sections below. (2004 RCP EIR)

Climate and Meteorology

Air quality is a function of both the rate and location of pollutant emissions under the influence of meteorological conditions and topographic features. Atmospheric conditions such as wind speed, wind direction, air temperature gradients and local topography influence the movement and dispersal of pollutants.

The SCAG region incorporates four air basins and five air districts. The four air basins are the South Coast Air Basin (SCAB), the Mojave Desert Air Basin (MDAB), the Salton Sea Air Basin (SSAB), and the Ventura County portion of the South Central Coast Air Basin (SCCAB). The five air districts are the South Coast Air Quality Management District (SCAQMD), the Mojave Desert Air Quality Management District (MDAQMD), the Imperial County Air Pollution Control District (ICAPCD), the Antelope Valley Air Quality Management District (AVAQMD), and the Ventura County Air Pollution Control District (VCAPCD). The geographic boundaries of these air basins and air districts are shown in Figure 3.4-1 located at the end of this document.

South Coast Air Basin (SCAB)

The SCAB incorporates approximately 12,000 square miles, consisting of Orange County and the urbanized areas of San Bernardino, Riverside and Los Angeles counties. In May 1996, the boundaries of the SCAB were changed by the California Air Resources Board (ARB) to include the Beaumont-Banning area. The distinctive climate of the SCAB is determined by its terrain and geographic location. The SCAB is a coastal plain with connecting broad valleys and low hills, bounded by the Pacific Ocean to the southwest and high mountains around the rest of its perimeter. The general region lies in the semi-permanent high-pressure zone of the eastern Pacific, resulting in a mild climate tempered by cool sea breezes with light average wind speeds. The usually mild climatological pattern is interrupted occasionally by periods of extremely hot weather, winter storms, or Santa Ana winds.1

The vertical dispersion of air pollutants in the SCAB is hampered by the presence of persistent temperature inversions. High-pressure systems, such as the semi-permanent high-pressure zone in which the SCAB is located, are characterized by an upper layer of dry air that warms as it descends, restricting the mobility of cooler marine-influenced air near the ground surface, and resulting in the formation of subsidence inversions. Such inversions restrict the vertical dispersion of air pollutants released into the marine layer and, together with strong sunlight, can produce worst-case conditions for the formation of photochemical smog. The basinwide occurrence of inversions at 3500 feet above sea level or less averages 191 days per year.2

The atmospheric pollution potential of an area is largely dependent on winds, atmospheric stability, solar radiation, and terrain. The combination of low wind speeds and low inversions produces the greatest concentration of air pollutants. On days without

inversions, or on days of winds averaging over 15 mph, smog potential is greatly reduced. 3

Mojave Desert Air Basin (MDAB)

In total the MDAB encompasses approximately 21,480 square miles and includes the desert portions of San Bernardino County, Riverside, Palo Verde Valley, and Palmdale and Lancaster in the Antelope Valley. The MDAB is bordered by the SCAB and the Riverside County line to the south, Kern County line to the west, the Arizona and Nevada borders to the north and east, and the eastern portion of Riverside County to the southeast. The Kern County portion of MDAB is not in the SCAG Region. The climate is characteristic of a desert environment. The intervening mountain ranges block cool, moist coastal air and create hot, dry summers and cool winters. Meteorology is influenced by a moderately intense anti-cyclonic circulation, except during periods of frontal activity during the winter. On average, 20-30 frontal systems (i.e. storms) move into the MDAB each winter.4

The MDAB experiences high prevailing winds primarily from the south and west, which result in a visible "smog wall" being transported from SCAB through mountain passes. The exchange of lower and upper air tends to accelerate surface winds during the warm part of the day when convection is at a minimum. During the winter the rapid cooling of the surface layers at night retards this exchange of momentum, which often results in calm winds. 5

The inversion conditions in the MDAB are much less favorable for the build-up of high ozone concentrations than in the coastal areas of Southern California. When subsidence inversions occur, they are generally 6,000 to 8,000 feet above the desert surface, allowing much greater vertical mixing than along the coast where the inversion base is often much lower. As a result, meteorology in the MDAB is less conducive for the chemical mixing characteristic of typical ozone formation. 6

Salton Sea Air Basin (SSAB)

The SSAB includes all of Imperial County and the desert portion of Riverside County between the SCAB and the MDAB (known as the Coachella Valley area). Imperial County extends over 4,597 square miles, bordering on Mexico to the south, Riverside County to the north, San Diego County on the west, and the State of Arizona on the east. 7

The southern portion of the SSAB is a part of the larger physiographic province of the Salton Trough. This province is a very flat basin surrounded by mountains: the Peninsular Ranges to the west, the Chocolate, Orocopia and Cargo Muchaco Mountains to the east. Most of the Trough is below sea level, and consists generally of desert, with agricultural land uses located at the north and south ends of the Salton Sea. 8

Climatic conditions in the SSAB are governed by the large-scale sinking and warming of air in the semi-permanent subtropical high pressure center of the Pacific Ocean. The high-pressure ridge blocks most mid-latitude storms except in the winter when the high-pressure ridge is weakest and farthest south. Similarly, the coastal mountains prevent the intrusion of any cool, damp marine air found in California coastal environs. Because

of the weakened storms and the mountainous barrier, the SSAB experiences clear skies, very low humidities, extremely hot summers, mild winters, and little rainfall. The flat terrain of the valley and the strong temperature differentials, created by intense solar heating, produces moderate winds and deep thermal convection. 9

The combination of subsiding air, protective mountains, and distance from the ocean all combine to severely limit precipitation. Rainfall is highly variable with precipitation from a single heavy storm exceeding the entire annual total during a later drought condition. 10

Humidities are low throughout the year, ranging from 28 percent in summer to 52 percent in winter. The large daily oscillation of temperature produces a corresponding large variation in the relative humidity. Nocturnal humidities rise to 50-60 percent, but drop to about 10 percent during the day. 11

The SSAB occasionally experiences periods of high winds. Wind speeds exceeding 31 mph occur most frequently in April and May. On an annual basis, strong winds (>31 mph) are observed 0.6% of the time and speeds of less than 6.8 mph account for more than one-half of the observed winds. Wind statistics indicate prevailing winds are from the west-northwest through southwest; a secondary flow maximum from the southeast is also evident. 12

Imperial County, in particular, experiences surface inversions almost every day of the year. Due to strong surface heating, these inversions are usually broken allowing pollutants to more easily disperse. Weak surface inversions are caused by cooling of air in contact with the cold surface of the earth at night. In valleys and low-lying areas, this condition is intensified by the addition of cold air flowing downslope from the hills and pooling on the valley floor. 13

The presence of the Pacific high-pressure cell can cause the air mass aloft to sink. As the air descends, compressional heating warms it to a temperature higher than the air below. This highly stable atmospheric condition, termed a subsidence inversion can act as a nearly impenetrable lid to the vertical mixing of pollutants. The strength of these inversions makes them difficult to disrupt. Consequently, they can persist for one or more days, causing air stagnation and the buildup of pollutants. Highest or worst-case ozone levels are often associated with the presence of this type of inversion. Subsidence inversions are common from November through June, but appear to be relatively absent July through October. 14

South Central Coast Air Basin (SCCAB)

The SCAG region includes the Ventura County portion of the SCCAB. Ventura County is comprised of coastal mountain ranges, the coastal shore, the coastal plain, and several inland valleys. The northern half of the County (Los Padres National Forest) is extremely mountainous with altitudes up to 8,800 feet. Consequently, the climate in the northern half of the County varies a great deal depending on elevation. Therefore, the climatological and meteorological description presented for Ventura County focuses on the southern half of the County where violations of federal and state ozone standards occur. 15

In the winter, low-pressure systems originating in the northern Pacific Ocean bring clouds, rain, and wind into Ventura County. The average annual temperature in the coastal and inland valleys of the southern half of Ventura County ranges from the upper 50s at the coast (Point Mugu) to the mid-60s in Simi Valley. The difference between the maximum and minimum temperatures becomes greater as the distance increases from the coast. The average minimum and maximum temperatures at Point Mugu are 50 F and 60 F, respectively, while at the inland location of Simi Valley, the averages are 52 F and 77 F. The smaller range of temperatures at Point Mugu demonstrates the moderating influence of the ocean on air temperature. The ocean's ability to warm and cool the air while its temperature remains relatively unchanged produces the moderating effect. Inland area temperatures are more prone to rapid fluctuations. 16

Almost all rainfall in Ventura County falls during the winter and early spring (November through April). Summer rainfall is normally restricted to scattered thundershowers in lower elevations, and somewhat heavier activity in the mountains. Humidity levels vary throughout the County. The range of humidity is primarily influenced by proximity to the ocean. Although the County's climate is semi-arid, average humidity levels are relatively high due to the marine influence. Coastal areas are more humid than inland areas during typical fair weather. The reverse is true during stormy periods. The lowest humidity levels are recorded during Santa Ana wind conditions. 17

Ventura County winds are dominated by a daily land-sea breeze cycle. The land-sea breeze regime is broken only by occasional winter storms and infrequent strong northeasterly Santa Ana wind flows. Since the sea breeze is stronger than the land breeze, the net wind flow during the day is from west to east. Under light land-sea breeze regimes, recirculation of pollutants can occur as emissions move westward during morning hours, and eastward during the afternoon. This movement can cause a build-up of pollutants over several days. 18

The vertical dispersion of air pollutants in Ventura County is limited by the presence of persistent temperature inversions. Approximately 60 percent of all inversions measured at Point Mugu are surface-based with most occurring during the morning hours. 19

III. EXISTING PLANS AND POLICIES

Regulatory Framework

Federal Regulations

Federal Clean Air Act (CAA)

The Federal Clean Air Act (CAA) requires attainment of National Ambient Air Quality Standards (NAAQS) for criteria air pollutants, i.e. pollutants causing human health impacts. The following criteria pollutants have been identified: ozone, particulate matter, carbon monoxide, lead, nitrogen dioxide, and sulfur dioxide. The original 1970 Clean Air Act required attainment by 1975. The Act was amended in 1977 and 1990 to extend the attainment deadlines. Current deadlines vary by pollutant and severity of pollution in the region.

U.S. Environmental Protection Agency (EPA)

The Federal CAA requires the EPA to establish national ambient air quality standards for air pollutants or air pollutant groups that pose a threat to human health or welfare. The primary responsibility for implementing and enforcing the provisions of the Clean Air Act rests within the individual states. This is accomplished through state implementation plans (SIPs), which must be submitted to the EPA for review and approval. SIP submittal schedules vary by air basin, pollutant and the severity of air quality problems.

Federal Air Quality Standards

The CAA requires the EPA to list air pollutant compounds which may endanger public health or welfare; to publish air quality "criteria" describing the latest scientific knowledge on these compounds, their pollutant interactions, and control techniques; and to identify the NAAQS protective of public health and welfare. Currently, EPA has established national standards for ozone (O3), carbon monoxide (CO), sulfur dioxide (SO2), nitrogen dioxide (NO2), particulate matter (PM10 and PM2.5), and lead (Pb). The national air quality standards are presented in Table XX. For each compound, this table describes health issues related to exposure to each pollutant and identifies the major source(s) of these emissions.

National standards consist of two parts: an allowable concentration of a pollutant and an averaging time over which the concentration is to be measured. The allowable concentrations are based on the results of studies of the effects of the pollutants on human health, crops and vegetation, and, in some cases, damage to paint and other materials. The averaging times are based on whether the damage caused by the pollutant is more likely to occur during exposures to a high concentration for a short time (e.g., one-hour) or to a relatively lower average concentration over a longer period (e.g., 8 hours, 24 hours, or 1 month). For some pollutants, there is more than one air quality standard, reflecting both its short-term and long-term effects. The following provides a description of the federal criteria pollutants.

Ozone (O3)

Ozone is a reactive pollutant, which is not emitted directly into the atmosphere, but is a secondary air pollutant produced in the atmosphere through a complex series of photochemical reactions involving reactive organic gases (ROG) and oxides of nitrogen (NOX). ROG and NOX are known as precursor compounds for ozone. Significant ozone production generally requires ozone precursors to be present in a stable atmosphere with strong sunlight for approximately three hours. Ozone is a regional air pollutant because it is formed downwind of sources of ROG and NOx under the influence of wind and sunlight. Short-term exposure to elevated concentrations of ozone is linked to such health effects as eye irritation and breathing difficulties. Ozone may pose its worst health threat to those who already suffer from respiratory diseases. In 1979, EPA promulgated the current ozone standard, 0.12 parts per million (ppm), which is measured over a one hour period (i.e. the 1-hour standard). This standard addresses peak concentrations of ozone typically seen in urban areas.

In 1997, EPA revised the ozone standard setting it at 0.08 ppm averaged over an 8-hour time frame. However, a number of events delayed implementation of the new 8-hour standard. In May 2003, the EPA released its proposed rule to implement the 8-hour ozone NAAQS and plans to issue a final rule by the end of 2003. The proposed rule

outlines steps that areas would be required to take to maintain or further clean their air and protect the public from ground-level ozone pollution.

In general, the 8-hour standard is more protective of public health and more stringent than the 1-hour standard because it addresses a broader period of time (i.e. a.m. and p.m. operation) and is more difficult to control. There are more areas that do not meet the 8-hour standard than there are areas that do not meet the 1-hour standard, including large areas of California. The South Coast Air Basin (SCAB) will be classified as a severe non-attainment area for the 8-hour standard. EPA will promulgate final attainment designations by April 15, 2004 (the 8-hour designations are consistent with the 1-hour designations for the SCAG Region). All areas not currently attaining the 1-hour standard, such as the SCAB, must submit an attainment demonstration plan within three years of designation (April 2007). The attainment dates vary by area and range between 2007 to 2021. The SCAB would have 17 years from that date of designation to demonstrate attainment (April 2021).

Carbon Monoxide (CO)

Carbon monoxide (CO) is a colorless, odorless and poisonous gas produced by incomplete burning of carbon in fuels. When CO enters the bloodstream, it reduces the delivery of oxygen to the body's organs and tissues. Health threats are most serious for those who suffer from cardiovascular disease, particularly those with angina or peripheral vascular disease. Exposure to elevated CO levels can cause impairment of visual perception, manual dexterity, learning ability and performance of complex tasks.

The NAAQS for carbon monoxide is 9 ppm 8-hour nonoverlapping average not to be exceeded more than once per year. An area meets the carbon monoxide NAAQS if no more than one 8-hour value per year exceeds the threshold.

Seventy-seven percent of the nationwide CO emissions are from transportation sources. The largest emissions contribution comes from highway motor vehicles. Thus, the focus of CO monitoring has been on traffic-oriented sites in urban areas where the main source of CO is motor vehicle exhaust. Other major CO sources are wood-burning stoves, incinerators and industrial sources.

Sulfur Dioxide (SO2)

Sulfur Dioxide (SO2) is formed through the oxidation of elemental sulfur; suspended sulfates are the product of further oxidation of SO2. High concentrations of SO2 affect breathing and may aggravate existing respiratory and cardiovascular disease. Sensitive populations include asthmatics, individuals with bronchitis or emphysema, children and the elderly. SO2 is also a primary contributor to acid deposition, or acid rain, which causes acidification of lakes and streams and can damage trees, crops, historic buildings and statues. In addition, sulfur compounds in the air contribute to visibility impairment in large parts of the country.

Ambient SO2 results largely from stationary sources such as coal and oil combustion, steel mills, refineries, pulp and paper mills and from nonferrous smelters. There are three NAAQS for SO2: 1) an annual arithmetic mean of 0.03 ppm (80 ug/m3); 2) a 24-hour level of 0.14 ppm (365 ug/m3); and 3) a 3-hour level of 0.50 ppm (1300 ug/m3).

The first two standards are primary (health-related) standards, while the 3-hour NAAQS is a secondary (welfare-related) standard. The annual mean standard is not to be exceeded, while the short-term standards are not to be exceeded more than once per year.

Nitrogen Dioxide (NO2)

Nitrogen Dioxide (NO2) is a brownish, highly reactive gas that is present in all urban atmospheres that is especially visible during periods of heavy air pollution. Nitrogen oxides are an important precursor both to ozone (O3) and acid rain, and may affect both terrestrial and aquatic ecosystems. The major mechanism for the formation of NO2 in the atmosphere is the oxidation of the primary air pollutant nitric oxide (NO). NOx plays a major role, together with VOCs, in the atmospheric reactions that produce O3. NOx forms when fuel is burned at high temperatures. The two major emissions sources are transportation and stationary fuel combustion sources, such as electric utility and industrial boilers. NO2 can irritate the lungs, cause bronchitis and pneumonia, and lower resistance to respiratory infections.

Particulate Matter (PM10 and PM2.5)

Air pollutants called particulate matter include dust, dirt, soot, smoke and liquid droplets directly emitted into the air by sources such as factories, power plants, cars, construction activity, fires and natural windblown dust. Particles formed in the atmosphere by condensation or the transformation of emitted gases such as SO2 and VOCs are also considered particulate matter.

Based on studies of human populations exposed to high concentrations of particles (sometimes in the presence of SO2) and laboratory studies of animals and humans, there are major effects of concern for human health. These include effects on breathing and respiratory symptoms, aggravation of existing respiratory and cardiovascular disease, alterations in the body's defense systems against foreign materials, damage to lung tissue, carcinogenesis and premature death. The major subgroups of the population that appear to be most sensitive to the effects of particulate matter include individuals with chronic obstructive pulmonary or cardiovascular disease or influenza, asthmatics, the elderly and children. Particulate matter also soils and damages materials, and is a major cause of visibility impairment in the United States.

Annual and 24-hour National Ambient Air Quality Standards (NAAQS) for particulate matter were first set in 1971. Total suspended particulate (TSP) was the first indicator used to represent suspended particles in the ambient air. Since July 1, 1987, however, EPA has used the indicator PM-10, which includes only those particles with aerodynamic diameter smaller than 10 micrometers. These smaller particles are likely responsible for most of the adverse health effects of particulate matter because of their ability to reach the thoracic or lower regions of the respiratory tract.

Lead (Pb)

Exposure to lead (Pb) can occur through multiple pathways, including inhalation of air and ingestion of Pb in food, water, soil or dust. Excessive Pb exposure can cause seizures, mental retardation and/or behavioral disorders. Infants and young children are

especially susceptible to low doses of Pb, Low doses of Pb can lead to central nervous system damage.

Lead gasoline additives, non-ferrous smelters, and battery plants are the most significant contributors to atmospheric Pb emissions. In 1993 transportation sources contributed 33% of the annual emissions, down substantially from 81% in 1985. Total Pb emissions from all sources dropped from 20,100 tons in 1985 to 4,900 tons in 1993. The decrease in Pb emissions from highway vehicles accounts for essentially the entire decline. The reasons for the significant decline can be attributed to two reasons: 1) Regulations issued in the early 1970's required gradual reduction of the Pb content of all gasoline over a period of many years and 2) As part of the EPA's overall automotive emission control program, unleaded gasoline was introduced in 1975 for automobiles equipped with catalytic control devices.

Since then, numerous programs have been implemented to control Pb emissions from stationary point sources. Lead emissions from stationary sources have been substantially reduced by control programs oriented toward attainment of the PM-10 and Pb ambient standards. The overall effect of the control programs for these three categories has been a major reduction in the amount of Pb in the ambient air.

CREATE Table XX: Ambient Air Quality Standards for Criteria Pollutants